HP 91731A Asynchronous Multiplexer Subsystem

Configuration Guide

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SECTION 1

SYSTEM PLANNING

1-1. HP 91731A SOFTWARE MODULES

The HP 91731A Asynchronous Multiplexer Subsystem is divided into two modules, the physical driver and the logical driver. The physical driver, DVS00, contains the default TTY character-mode-only logical driver. DVS00 must be generated into the system driver area of an RTE-IV operating system.

There are two versions of DVS00, one to support up to 16 ports, and one to support up to 32 ports (two multiplexers). The size requirements, part numbers, and names of the relocatable modules for these two versions are shown in Table 1-1.

Table 1-1 HP 91731A Modules: Part Numbers and Approximate Size

The logical driver, LDVR5, comes in two different configurations; each configuration has a 16- and a 32-port version. One configuration supports block or character mode transfers, cassettes and auxiliary printers; the other supports only the block and character mode transfers. LDVR5 must be generated into the subsystem global area (SSGA) of an RTE operating system.

In addition to the HP 91731A modules in RTE-IV the module PVMP4 (%4PVMP 92067-16001) using 66 words of memory must be used, or in RTE-M the module $PVMP (%$PVMP 92060-16035) must be used. Also, 26 words of EQT storage are required for each terminal connected to the multiplexer.

1-2. TERMINALS

The HP 91731A Asynchronous Multiplexer Subsystem will support up to 16 terminals on an HP 12920B interface kit or 32 terminals if two interface kits are used.

1-3. Supported Terminals

Table 1-2 lists the HP terminals that are supported by the HP 91731A Asynchronous Multiplexer Subsystem. Information is included to indicate which strap options are recommended and what cables are required for each terminal. While other manufacturers' terminals may be compatible, they are not supported by Hewlett-Packard.

Table 1-2. HP Terminals Supported by HP 91731A

Terminal	Cable Required	Recommended Strapping Options
2621A/P	13222N	Straps: bcgHxz Handshake: Etx
2631A Option 40	Supplied with term.	
2635A	Supplied with term.	
2640A/B	13232A	A,B,E-H,J-Z Closed C,D as req'd.
2645A	13232A	Same as 2640A
2648A	13232A	Same as 2640A

1-4. Terminal Speed and System Throughput

Terminals may be run at a maximum of 2400 baud; however, simultaneous use of all terminals at that data rate is not possible. Overall system throughput is a function of CPU and memory speed, and it is possible to overrun the Multiplexer input capabilities and lose data. Loss of data on any port will cause an error (time-out) on that port so that corrective action may be taken.

The worst-case system throughput is on an HP 1000 M-Series Computers where the maximum total data rate is 5900 baud. The throughput for the HP 1000 E-Series Computer with standard memory is 10,000 baud. For an F-Series or E-Series Computer with high speed memory, the maximum throughput is 12,000 baud. Operation at or near these limits is not recommended.

Figure 1-1 shows CPU overhead as a function of system throughput. The three plots represent the three computer configurations mentioned above using an RTE-IV Operating System, one Multiplexer installed, the DVS00/LDVR5 combination on each terminal used, and no other system activity. The overall system throughput is not substantially affected by the number of terminals used, the speed settings on the individual terminals, or the number of 12920B Multiplexers installed.

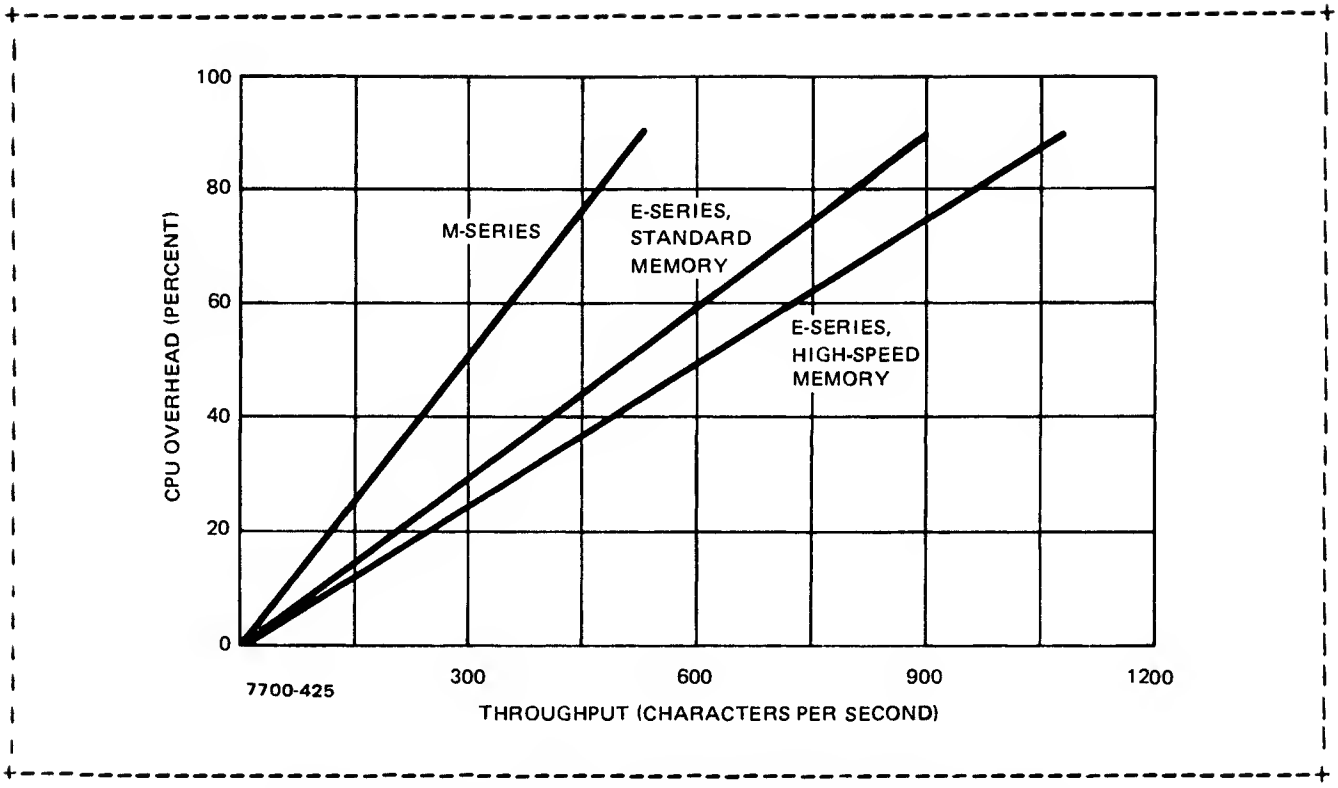


Figure 1-1. Overall Multiplexer Throughput

As an example of throughput limitation, consider that a terminal operating at 300 baud transfers data at 30 characters per second. Sixteen 300-baud terminals operating concurrently would require the CPU to handle 480 characters per second which, referring to Figure 1-1, is well within the capabilities of either CPU configuration. If the baud rates were raised to 1200, the CPU would be attempting to handle 120 x 16, or over 1900 characters per second, which is beyond its capability.

Note that extreme caution is required when multiple terminals are communicating simultaneously in block mode, with cassettes or when other privileged (non-interruptable) operations are being performed. (A maximum of four concurrent 2400-baud block-mode transfers is typical with an E-Series Computer.)

In the event that these limitations are exceeded, requests for interrupts will be generated faster than they can be serviced. This will result in a data loss on input channels and/or a slow-down of data on the output channels. Output degradation may not be uniform across all channels. Data loss will be reported as an error causing a time out and downing the device if this option was specified when terminal was enabled.

1-5. Minimizing Data Losses

Input data loss problems can be practically eliminated by restricting terminal operation to character mode only. While this eliminates the use of block mode and cassettes, the greater data integrity guaranteed by this scheme may justify its use in applications requiring concurrent activity of many terminals.

A second possible technique to deal with input data loss utilizes the split speed capability of 264X terminals and the Multiplexer. Split speed operation allows for reduced terminal transmit speeds (a typical maximum typing speed is 150 baud anyway) while maintaining maximum receive speeds. While this method does not positively eliminate the data loss problem, it significantly reduces the possibility of loss. Note that, when in split speed mode, echoplex and modems cannot be used, nor can the speed sense capability be exploited.

1-6. Terminal Placement and Distance without Modems

For direct connection of terminals (without modems), use of short cables (15 meters or 50 feet) is recommended. Longer cables may be used, provided the interface characteristics conform to the EIA RS-232C interface specification. The limiting factor is the total load capacitance, which must not exceed 2500 picofarads. For details consult the EIA Standard, RS-232C, and the HP 12920B Asynchronous Multiplexer Reference and Application Manual.

1-7. MODEMS

When distances become excessive, or it is more convenient to use telephone lines to connect the computer to a terminal, the use of modems is recommended.

1-8. Supported Modems and Strap Options Required

Table 1-3 lists the modems for which use with the HP 91731A Asynchronous Multiplexer Subsystem is supported by Hewlett-Packard. The following tables show the recommended strap options for using these modems with the Multiplexer Subsystem. These charts reflect information available at press time for this manual. Refer to the manuals provided with the particular modems for details pertaining to these or other possible options, and for instructions on setting these options into the modems.

Table 1-3. Supported Modems

Manufacturer	Model(s)
American Telephone and Telegraph Company (Bell)	103A, 212A
Vadic Corporation	VA3400

Use of these modems with the Multiplexer Subsystem is supported by Hewlett-Packard in the United States and Canada. In areas outside of the United States and Canada, check with the public telephone authority or independent modem supplier and the local Hewlett-Packard representative to determine modem compatibility with th HP 91731A Multiplexer Subsystem and the HP 12920B Multiplexer interface.

Table 1-4. Strap Options for Bell Type 103A2 Modem

Option	Description	Recommendation
A1 A2	With auto calling unit Without auto calling unit	A2 is required
B3 B4	Auto answer permanent Auto answer key-controlled	B3 is recommended
C5 C6	Terminal response to disconnect No response to disconnect	C5 is required
D7 D8	Terminal initiates disconnect Terminal does not initiate	D7 is required
E9 E10	Mark hold Space hold	E9 is required

Table 1-5. Strap Options for Bell Type 103A3 Modem

Option	Description	Recommendation
A1 A2	Rotary Dial Touch-tone	Select option that best meets your needs
B3 B4	With card dialer Without card dialer	B4 (Dialer is not supported)
C5 C6	Loss of CXR disconnect No loss of CXR disconnect	C5 is required
D7 D8	Send space disconnect No send space disconnect	As required by user
E9 E10	Receive space disconnect No receive space disconnect	As required by user
F11 F12	Auto answer permanent Auto answer selective	F11 is recommended

Table 1-6A. Modem Type 212A Strap Options (Part 1)

Feature	Choice	Description	Req
CC Indication For Analog Loop	On	CC ckt. on during AL test	
	Off	CC ckt. off during test	2
Speed Control	Interface	CH circuit controls speed	
	HS Button	HS Button controls speed	1
Interface Controlled Make Busy/ Analog Loop	In	Make Busy/AL controlled by CN ckt or AL button	
	Out	Controlled by AL only	1
Transmitter Timing	Internal	1200BPS Internal clock	1
	External	1200BPS Driven by DA ckt.	
	Slave	1200BPS Driven by receive	
1200BPS Operation	Async/Stop-Start	Character-oriented in high-speed mode	1
	Synchronous	Bit-synchronous HS mode	
Character Length	9 Bit	Character format is 9 bit for 1200BPS async	
	10 Bit	10 bit character format	1
Receiver Responds To Digital Loop	In	Digital loop can be remotely requested in HS	1
	Out	No response to remote request for digital loop	
Interface Controlled Remote Digital Loop	In	RL ckt. enabled to activate remote digital loop	
	Out	RL ckt. not connected	1
Loss Of Carrier Disconnect	In	Call dropped on carrier loss	2
	Out	Call not dropped	

1 Indicates required for operation with 91731A.
2 Recommended, but not required.
No entry in the Req column indicates any option consistent with 212A modem operation may be used.

Table 1-63. Modem Type 212A Strap Options (Part 2)

Feature	Choice	Description	Req
Receive Space Disconnect	In	Call dropped on steady space receive	
	Out	Call not dropped	2
CB And CF Indications	Common	CB ckt. turned off when CF ckt. goes off	2
	Separate	CB unaffected by CF	
Send Space Disconnect	In	Steady space sent before disconnecting	
	Out	Space not sent	
Automatic Answer	In	Auto answer if CD on	2
	Out	No response to ring	
Answer Mode Indication-CE	On	CE on after answer	
	Off	CE off after answer	
Speed Mode	High	High speed mode only	
	Dual	Both speed modes allowed	2
Interface Speed Indication	In	CI indicates speed mode	
	Out	CI not connected	2
CN And TM Assignments	CN25, TM NC	CN pin 25, TM not conn.	1
	CN18, TM NC	CN pin 18, TM not conn.	
	CN18, TM25	CN on pin 18, TM on 25	
Signal Ground To Frame Ground Connection	In	Frame gnd tied to sig gnd	
	Out	Frame gnd NC signal gnd	2

1 Indicates required for operation with 91731A.
2 Recommended, but not required.
No entry in the Req column indicates any option consistent with 212A modem operation may be used.

Table 1-7A. Vadic VA3400 Modem Strap Options (Part 1)

Block	No.	Req	Description
A.			ABT and Disconnect Options
	1.\		12.8 second Abort Out
	2./	*	12.8 second Abort In
	3.	*	.8 second Disconnect (Carrier Off Disconnect)
	4.\	*	In=SH Off Disconnect
	5./		In=Manual Originate/Answer - Unattended Disconnect
	6.\	*	3 Second ABT
	7./		6 Second ABT
B.			Data Options
	1.\		External Sync
	2./	*	Async/Internal Sync
	3.\		1200 bps \
	4.		600 bps |- As required
	5./		300 bps /
	6.	*	10 bit Both In = 11 bit
	7.		9 bit Both Out = 8 bit
	8.		External bit rate select
C.			Dialer/Mode Options
	1.\	*	In = Standard Chassis
	2./		In = 1601 ACU
	3.		P1-K In (For Line Monitor Card)
	4.		Special Purpose Dialing (Dialing via 00S)
	5.\	*	Originate/Answer Mode
	6./		Answer Only Mode
	7.	*	Out=Use with Dialer (Pin 8 of DAA Connector)
			(In grounds pin 8)
D.			Diagnostics
	1.	*	Enable response to remote test
	2.	*	Enable analog loop back
	3.		Enable remote test external
	4.		Enable local test/busy out external (00S)

* Indicates configuration for use with 91731A. Numbers within Brackets indicate one switch (strap) must be on (in).

Table 1-7B. Vadic VA3400 Modem Strap Options (Part 2)

Block	No.	Req	Description
E.			Modem Protocol
	1.	*	103
	2.		202 Neither = 201
	3.		Out = Disable secondary transmit
	4.		DTR = On
	5.		202 -5 baud reverse channel
	6.\		CF = CB
	7./	*	CF = CXR
F.			Interface & DAA Reference (Set Per Modem Directions)
G.			DAA (Switched Network) Or Leased Line Interconnect (Set Per Modem Directions)
H.			Switched Network/Lease Line Point to Point/Lease Line Multi-Drop Options (Set Per Modem Directions)

* Indicates configuration for use with 91731A. Numbers within Brackets indicate one switch (strap) must be on (in).

1-9. I/O CONFIGURATION

The Multiplexer Subsystem requires the use of a minimum of four and a maximum of seven I/O channels (select codes). Three I/O channels are used for the three HP 12029B Interface boards (six if two Multiplexers are used) and one I/O channel is required for the privileged interrupt fence.

The Multiplexer boards should be installed in three consecutive I/O channels. For example if the highest priority channel for the Multiplexer were select code 10, the boards would be installed as follows:

Select Code	Multiplexer Board
10	Lower Data (12920-60002)
11	Upper Data (12920-60001)
12	Control (12922-60001)
13	Privileged Fence (HP 12936A or HP 12620A)

If two Multiplexers are used, the sequence in select codes 10, 11, and 12 is repeated in select codes 13, 14, and 15, and the privileged interrupt fence is in select code 16.

The interface boards should be installed as low as possible in the computer's I/O card cage, and the privileged interrupt fence board should be installed above the Multiplexer boards.

NOTE

Other privileged select codes may be inserted below the privileged interrupt fence either above or below the multiplexer boards; however if activity is occurring on these select codes concurrently with Multiplexer activity, system throughput will be degraded and line errors may be generated on either subsystem.

1-10. INCOMPATIBILITIES

Use of the following HP products and features with the Multiplexer Subsystem is not supported. The particular feature or incompatibility is described for each individual product.

- RJE/1000 (91780A) may not be run while the Multiplexer Subsystem is active. Line errors on both RJE/1000 and the Multiplexer will occur.
- DS/1000 (91740A/B, 91741A) may not use privileged data communications while the Multiplexer is active. There is a possibility for line errors if they are used concurrently.
- DATACAP/1000 (92903A) may not use a Multiplexer port for input and output.
- The system console may not be connected to the system through the Multiplexer. Use of a Multiplexer terminal as system console causes problems at boot-up.
- HP-ATS: The Multiplexer Subsystem is not compatible with an HP Automatic Test System.

- Writable Control Store (HP 13971A WCS kit): Care must be taken when loading the WCS board via DCPC while the Multiplexer is active. Once a DMA transfer to a WCS board has been initiated, the DCPC steals every memory cycle until the transfer is complete. Loading the 1024 locations on a WCS board (about 3.33ms for an M-Series Computer) may cause incoming data to the Multiplexer to be lost.

- Any HP or user code that is privileged (non-interruptable) must be used with care. For one channel operating at 2400 baud, the CPU must recognize the interrupt to process each character on that channel every 4.17 milliseconds. On an E-Series CPU it takes about one millisecond to process each character. If two channels are running at 2400 baud, then two characters must be processed in that 4.17-millisecond period. Thus, if several terminals are processing 2400-baud block reads and some program turns off the interrupt system for any amount of time, it is possible to lose data.

SECTION 2

SYSTEM GENERATION

The following paragraphs outline the recommended procedure for generating an HP 91731A Multiplexer Subsystem into an RTE Operating System. Examples in the form of filled-in generation work sheets are given to show the steps required. A comprehensive example of an RTE-IV generation is given in an Appendix.

The physical driver, DVS00, will be relocated into the System Driver Area of the RTE-IV Operating System. This is accomplished by using the M parameter in the EQT Table portion of the generation. In RTE-M the M parameter may not be used, and is not required since all drivers are in the system map. The RTE module PVMP4 (%4PVMP 92067-16001) taking up 66 words must be relocated with DVS00 into the system Driver Area. In RTE-M the module is $PVMP (%$PVMP 92060-16035).

The logical driver, LDVR5, will be relocated into the SSGA portion of the RTE Operating System. No action is required to force this relocation, since the LDVR5 module is a type-30 program, which is automatically placed into SSGA.

To accommodate sixteen terminals per Multiplexer, sixteen EQT entries of 26 words each are required. Also, 16 dummy Interrupt Table entries must be generated referencing 16 dummy select codes per Multiplexer. The 16 dummy select codes must be consecutive and start at octal 40.

Two Interrupt Table select code entries must also be included, one for the lower Multiplexer data board select code and one for the Multiplexer control select code. If a second Multiplexer is used, two more real select codes corresponding to the second Multiplexer control and lower data boards, and 16 more dummy select codes starting at octal 60 must be used.

Note that if all 16 (or 32) ports are not to be used, unused ports need not have EQT's or LU's assigned; however, the Multiplexer EQT's must still be consecutive. For example, if 20 ports are required, put the first 16 on the lower Multiplexer and the last four on the upper Multiplexer.

A Device Reference Table (DRT) entry must be generated for each Logical Unit (LU) to be used. A different LU number should be assigned to each individual terminal, CTU, and auxiliary printer attached to the Multiplexer.

NOTE

The LU number for a CTU or auxiliary printer must be higher than the LU number for the terminal to which the CTU or printer is connected.

In the following examples the circled step numbers refer to the steps in Section 3 of the RTE-IV On-Line Generator Reference Manual. While the step numbers are not referenced in the RTE-M System Generation Manual the procedure is basically the same. Where differences occur, they are noted.

The example system generated is for up to 16 ports with CTU's and printers supported by LDVR5.

2-1. INITIALIZATION PHASE: PRIVILEGED INTERRUPT SELECT CODE

Step 10 specifies the select code where the Privileged Interrupt Fence Board is located in the CPU I/O section. The Privileged Interrupt select code must be above the three multiplexer boards.

```
+-------------------------------------------------------------------+
|                                                                   |
|   (10) PRIV. INT. SELECT CODE?                                    |
|        PV                        (oct. select code or 0)          |
|                                                                   |
+-------------------------------------------------------------------+
```

where PV is the select code of the privileged interrupt fence.

In RTE-M, the next question is:

PRIVILEGED DRIVERS ACCESS COMMON?

answer this with:

YES

2-2. PROGRAM INPUT PHASE

Step 17c specifies the modules to be relocated by their relocatable file names with optional security code and disc cartridge specification. One or two Multiplexer Subsystem modules must be relocated (see Table 1-1 for selection) along with the RTE module PVMP4 ($PVMP in RTE-M). The order of relocation for the Multiplexer modules is not important in RTE-IV.

In RTE-M the module LDVR5 must be relocated when the generator prompts with RELOCATE SSGA. This occurs in the PROGRAM PARTITION/PARAMATER INPUT phase, which is after the TABLE GENERATION phase. In the example below, 1904 is a sample cartridge label number.

(17c) Enter the RELOCATE commands (with optional MAP, LINKS IN, and DISPLAY commands)

```
REL ,%DVSON::1904                    (REL [(name)] ,filename [: sc [: cartridge label]])
REL ,%LD5AZ::1904                    (RT4GN responds with a — after each user input)
REL ,%4PVMP::1904
```

2-3. TABLE GENERATION PHASE

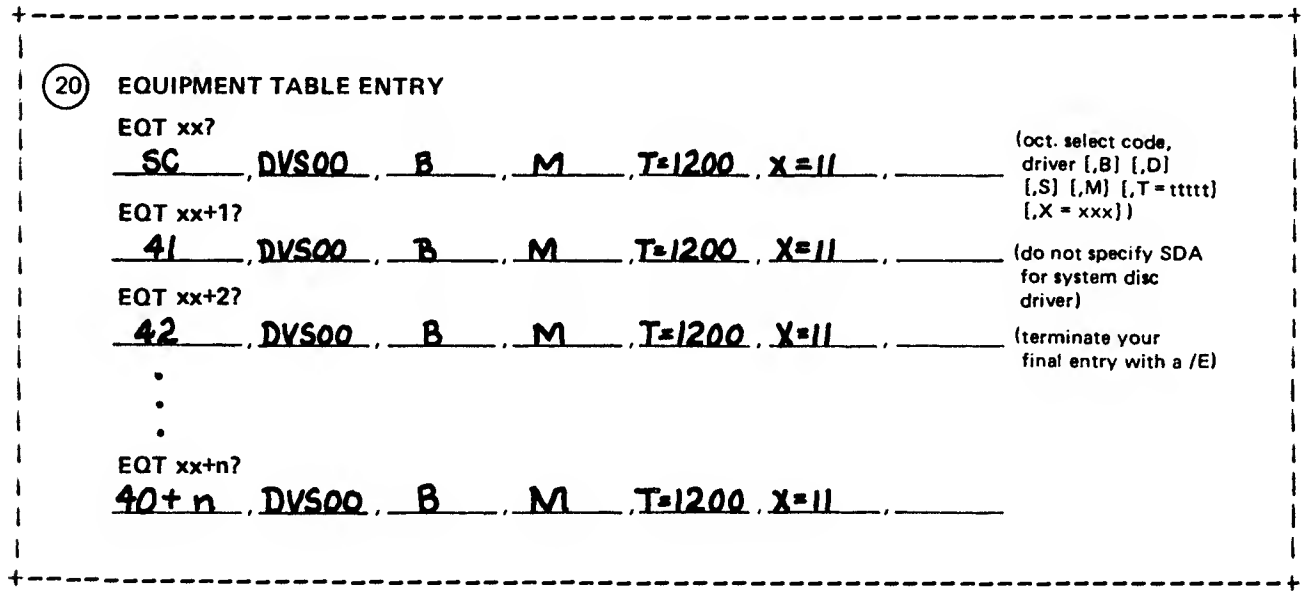
2-4. Equipment Table Entries

Step 20 specifies the EQT entries for the Multiplexer Subsystem. The first Multiplexer EQT, designated as EQT xx in this example, will reference the lowest select code used by the Multiplexer boards. This is used by the driver to locate the real select codes of its interface cards. It will be patched to 40 (octal) on first call to driver. The following EQT entries, designated EQT xx+i (i=1,2,...,15 for 16 Multiplexer ports) will reference the dummy select codes 40(octal)+i.

If a second Multiplexer is used the first EQT for the second Multiplexer will reference the select code of the lowest board of that Multiplexer and the subsequent EQT's will reference dummy select codes 60(octal)+i.

Each EQT entry should specify buffering (B), driver does mapping (M), and EQT extent of 11 words (X=11). An optional time-out value in hundreds or milliseconds (T=ttttt) may also be specified. The time-out specification is different from that of a normal driver, where the time-out is specified in tens of milliseconds. The range of values for ttttt is 1 to 32767, specifying the number of 1/10 seconds (100ms).

In RTE-M the Equipment Table entries are the same except for the M parameter, which is not used.



where SC is the lower Multiplexer select code and n+1 is the number of ports to be utilized on the Multiplexer.

2-5. Device Reference Table Entries

Step 21 specifies the DRT entries for the Multiplexer. There should be one entry for each port to be utilized by a terminal and one entry for each CTU and auxiliary printer connected to the Multiplexer through a terminal. The LU numbers for CTU's and printers should be higher than the LU number for their respective terminals. The entries are in LU number order, so it is advisable to enter the CTU and printer entries after completing the terminal entries (CTUs and printers available only with LDVR5).

Each entry in the Device Reference Table is the EQT number of the Equipment Table entry for a port. The Device Reference Table entries are in LU number order. The terminal on that port will be referred to by the LU number of the current Device Reference Table entry. The EQT number is followed by the subchannel number for a CTU or printer if applicable. Subchannel zero (the terminal subchannel) is the default subchannel. The left CTU is subchannel 1, the right CTU is subchannel 2, and the auxiliary printer is subchannel 4.

In the following example, xx refers to the EQT number (Step 20), yy refers to the LU number, and n+1 is the number of terminals to be used. Two CTU's and a printer are assigned to the first port available.

```
(21)  DEVICE REFERENCE TABLE
        yy = EQT #?
          XX  ,
      yy+1 = EQT #?
          XX+1  ,
            .
            .
            .
      yy+n = EQT #?
          XX+n  ,
    yy+n+1 = EQT #?
          XX  , 1
    yy+n+2 = EQT #?
          XX  , 2
    yy+n+3 = EQT #?
          XX  , 4
```

2-6. Interrupt Table Entries

Step 22 specifies the interrupt table and trap cell entries for the Multiplexer. Two entries are required at the select codes for the lower Multiplexer data board and control board. These two entries should specify the driver data and control entry points P00D1 and P00C1 respectively (e.g.: sc,ENT,P00D1). Entries are also required at dummy select codes for each Multiplexer port used. These entries must be sequential starting at select code 40 (octal) and specify program scheduling (e.g.: 40,PRG,PRMPT) or a linkage to an EQT entry number (e.g.: 40,EQT,14).

If two Multiplexers are used, the above is repeated using the second Multiplexer lower and upper select codes and dummy select codes starting at 60 (octal). The second Multiplexer uses entry points of P00D2 and P00C3 for the second Multiplexer lower data board and control board respectivly.

In the following example, SC specifies the lower Multiplexer select code as defined in step 20, and n+1 is the number of ports to be used on the Multiplexer.

```
(22) INTERRUPT TABLE                    (enter octel select codes in ascending order)
                                        (generetor prompt)
     SC      ,ENT   ,P00D1              (select code, option, destination)
     SC+2    ,ENT   ,P00C1              (terminete your final entry with a /E)
       .
       .
       .
     40      ,PRG   ,PRMPT
     41      ,PRG   ,PRMPT
       .
       .
       .
     40+n    ,PRG   ,PRMPT
```

2-7. PARTITION DEFINITION PHASE: SYSTEM AVAILABLE MEMORY

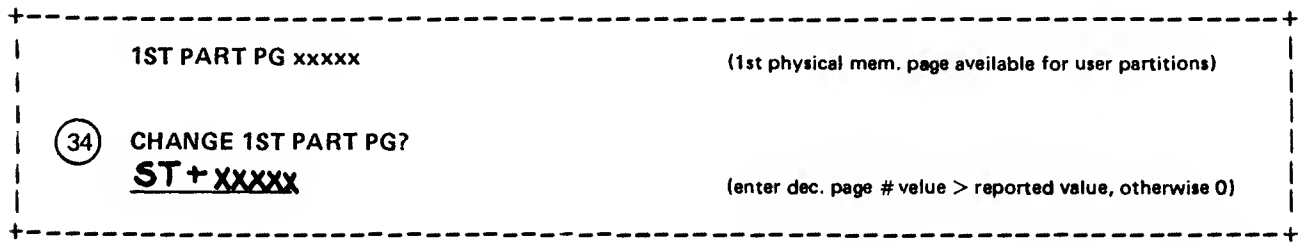
Step 34 allows the system manager to increase the size of system available memory (SAM) by moving the starting page of the first user partition to a higher location in memory.

If the terminals on the Multiplexer are buffered, additional SAM should be allocated in order to prevent programs from being suspended waiting for memory. The number of pages of SAM required by the Multiplexer for worst case analysis can be determined by the following formula:

$$S = HBL \times n/1024$$

where HBL is the High Buffer Limit as defined in step 29 (see the RTE-IV On-Line Generator Manual), and n is the number of terminals used by the multiplexer. The result, S, should be rounded up to the next integer page. It should be noted that this is the SAM requirement for the multiplexer only, and should be added to the requirements generated by other subsystems and drivers.

To input the proper response at step 34 of the generation, add the total SAM requirement (ST in the example where ST = S + all additional SAM requirements) to the page number reported by the generator as being the 1ST PART PG (xxxxx in the example).



SECTION 3

INSTALLATION AND INITIALIZATION

3-1. HP 12920B ASYNCHRONOUS MULTIPLEXER HARDWARE INSTALLATION

Install the Multiplexer Lower Data PCA (12920-60002) in the lower Multiplexer select code defined during generation. Install the Multiplexer Upper Data PCA (12920-60001) in the select code above the Lower Data PCA. Install the Multiplexer Control PCA (12922-60001) in the next higher select code. Connect the three Multiplexer boards to the Connector Panel (30062-60017) using the Data Cable (12921-60003) and Control Cable (12922-60003) as described in the HP 12920B Asynchronous Multiplexer Reference and Application Manual (12920-90007).

Connect the terminals to the Connector Panel using the cables specified in Table 1-2. Set up and turn on the terminals as specified in the instruction manual for the terminal. Make sure that all terminals are strapped and configured (parity and baud rate set) in the manner that the initializing program expects them to be. (See the next subsection for an initializing program example.)

3-2. INITIALIZATION

Before accessing a Multiplexer port, an initialization procedure must be run to pass port characteristics to the interface. See the HP 91731A Multiple Subsystem User's Guide for details.

Figure 3-1 is a sample initialization program that could be used to initialize a Multiplexer port. To schedule the program, enter:

```
:RU,INIT,lu
```

The command must be run for each port.

This example may be used for the configuration:

- both DVS00 and LDVR5 in this system.
- 262X or 264X terminal hardware, no parity, 2400 baud, strapped per Table 1-2.

NOTE

All programs that call LDVR5 must be loaded with SSGA access declared. Do this by specifying the SS option when running the loaded (OP,SS).

```
FTN4,L
      PROGRAM INIT
C
C THIS PROGRAM INITIALIZES A MULTIPLEXER TERMINAL.
C LU NUMBER OF TERMINAL IS PASSED IN FIRST PARAMETER.
C THE FOLLOWING CONDITIONS ARE SET:
C
      DIMENSION LU(5)
      DATA IBAUD/5B/,IRS/500B/,ITS/1600B/,LDVR/2500B/
      DATA IENAB/2000B/,IPRAM/130210B/,ICODE/3/,IUPST/3200B/
C
C GET LU NUMBER
C
      CALL RMPAR(LU)
C
C SET RECEIVE BAUD RATE AT 2400 BAUD
C
      ICNWD = LU + IRS
      REG = EXEC(ICODE,ICNWD,IBAUD)
C
C SET TRANSMIT BAUD RATE AT 2400 BAUD
C
      ICNWD = LU + ITS
      REG = EXEC(ICODE,ICNWD,IBAUD)
C
C GET LOGICAL DRIVER ADDRESS AND PASS TO PHYSICAL DRIVER
C
      CALL LDVR5(IADDR)
      ICNWD = LU + LDVR
      REG = EXEC(ICODE,ICNWD,IADDR)
C
C READ TERMINAL UPDATE STATUS FOR PAGE OR LINE BLOCK MODE READS
C OR CHARACTER MODE READS
C
      ICNWD = LU + IUPST
      REG = EXEC(ICODE,ICNWD)
C
C ENABLE TERMINAL WITH BACKSPACE, NO DOWN ON TIME-OUT, ONE STOP
C BIT, NO PARITY, AND 8 BIT CHARACTERS
C
      ICNWD = LU + IENAB
      REG = EXEC(ICODE,ICNWD,IPRAM)
      END
      END$
```

Figure 3-1. Sample Terminal Initialization Program

SECTION 4

MAINTENANCE AND TROUBLESHOOTING

When your system has been generated, booted up, and the Multiplexer terminals initialized according to the instructions in the preceding sections of this manual, your Multiplexer terminals should respond to pressing of any key with the multiterminal monitor prompt (i.e. lu>), in a manner identical to that of any DVR05 or DVR00 terminal. If a Multiplexer terminal fails to respond properly, the following checklist may help to correct the problem:

- Verify that the baud rate of the terminal matches the baud rate expected by the software.
- Check that the terminal strap switches are set according to Table 1-2 and the terminal instruction manual.
- Verify that the cables are connected properly according to the HP 12920B Asynchronous Multiplexer Reference and Application Manual and the terminal and/or modem instruction manual.
- Verify that the physical board configuration matches the generation configuration, and that the Multiplexer boards are in the right order (see Installation and Initialization).
- Verify that the Time Base Generator interrupts are being processed by running WHZAT or using the system TI command to verify that the time is incrementing. (Privileged drivers require an immediate time-out for completion.)

The transfer file shown in Figure 4-1 can serve as a test program for a Multiplexer installation to verify proper operation. The transfer file should be executed from the file manager on the system console. It is interactive, requiring the user to input messages from both the system console and the Multiplexer terminal under test.

```
:**       ASYNC MULTIPLEXER CHECKOUT PROCEDURE FILE
:**     PROVIDES A QUICK CHECKOUT OF A TERMINAL ON THE 12920B
:**     MULTIPLEXER UNDER 91731A SOFTWARE.
:**
:**     CALL FROM FMGR      :TR,*CKOUT,LU,BAUD,CTU,PRINTR
:**
:**     WHERE  LU IS LU OF DISPLAY/KEYBOARD OF TERMINAL TO TEST
:**            BAUD IS BAUD RATE OF TERMINAL  (MAX 2400)
:**            CTU IS LU OF CASSETTE TAPE UNIT
:**            PRINTR IS LU OF AUX PRINTER
:**     NOTE:    IF CTU OR PRINTER ARE TO BE TESTED, LDVR5 MUST
:**              BE ATTACHED TO DVS00 BEFORE RUNNING THIS TEST!
:**              SET CTU OR PRINTR TO ZERO IF THEY ARE NOT TO
:**              TESTED.  (E.G. :TR,*CKOUT,14,2400,0,33)
:**
:**        ******** MUST BE CALLED FROM SYSTEM CONSOLE *********
:**
:SV,1
:TE,*       ENTER A FEW LINES OF TEXT TO BE USED AS A TEST MESSAGE
:TE,*       IN THIS TEST.  WHEN DONE TYPE <CONTROL>D
:ST,1,@@MESG
:TE,*       THANK YOU
:CA,5,14400,/,2G
:CA,5,5G,-,1
:CN,1G,5,5G
:CN,1G,16B,5G
:DU,@@MESG,1G
:TE,*       TEST MESSAGE SHOULD BE DISPLAYED ON THE TEST TERMINAL
:TE,*
:TE,*       TYPE IN A MESSAGE ON THE TERMINAL UNDER TEST.
:TE,*       IT SHOULD BE ECHOED HERE.  WHEN DONE TYPE <CONTROL>D
:DU,1G,1
:IF,3G,EQ,0,8
:TE,*       ***CTU TEST***
:CN,3G,RW
:DU,@@MESG,3G
:CN,3G,RW
:TE,*       THIS SHOULD BE THE TEST MESSAGE:
:DU,3G,1
:CN,3G,RW
:TE,*       ** END OF TAPE TEST **
:IF,4G,EQ,0,4
:TE,*       ** PRINTER TEST **
:TE,*       TEST MESSAGE SHOULD BE DISPLAYED ON THE PRINTER
:DU,@@MESG,4G
:TE,*       ** END OF PRINTER TEST **
:PU,@@MESG
:TE,*       END OF TEST
```

Figure 4-1. Multiplexer Installation Test Program

SYSTEM GENERATION EXAMPLE

```
ECHO?
YES                     * ECHO ON

EST. # TRACKS IN OUTPUT FILE?
40                      * ESTIMATED # OF TRACKS

OUTPUT FILE NAME?
MUXSYS::2               * 770822

SYSTEM DISC?
7900                    * TARGET DISK

CONTROLLER SELECT CODE?
21                      * DISK CHANNEL

# TRKS, FIRST TRK ON SUBCHNL:
  0?
203,0                   * SUBCHANNEL 0
  1?
203,0                   * SUBCHANNEL 1
  2?
/E

SYSTEM SUBCHNL?
1                       * SYSTEM SUBCHANNEL

AUX DISC (YES OR NO OR # TRKS)?
NO                      * NO AUX DISK

TBG SELECT CODE?
14                      * TBG

PRIV. INT. SELECT CODE?                    \ P.I. card
13                      * PRIV. INT.       / required by
                                             MUX Subsystem

MEM. RES. ACCESS TABLE AREA II?
YES                     * MR ACCESS TA II

RT MEMORY LOCK?
YE                      * RT MEMORY LOCK

BG MEMORY LOCK?
YE                      * BG MEMORY LOCK
```

```
SWAP DELAY?
50                    * SWAP DELAY

MEM SIZE?
128                   * MEM SIZE

BOOT FILE NAME?
0                     * NO BOOT FILE


PROG INPUT PHASE:
-
MAP GLOBALS,MODULES,LINKS
-
LINKS IN CURRENT
-
*                        RTE-IV SYSTEM
-
REL,%CR4S1::1904            * SYSTEM PART 1
-
REL,%CR4S2::1904            * SYSTEM PART 2
-
REL,%$CNFX::1904            * CONFIGURATOR EXTENSION
-
REL,%4MTM::1904             * MULTI-TERMINAL MONITOR
-
*                        DRIVERS
-
REL,%DVR00::1904            * TTY/READER/PUNCH
-
REL,%4DV05::1904            * 2645/2648 CRT
-
REL,%DVR12::1904            * 2767 LINE PRINTER
-
REL,%DVR23::1904            * 7970 MAGTAPE
-
REL,%DVR31::1904            * 7900 DISK
-
REL,%DVS0N::1904            * MUX PHYSICAL DRIVER FOR 16 PORTS
-
REL,%LD5AZ::1904            * MUX LOGICAL DRIVER FOR 16 PORTS WITH CTU'S
-
REL,%4PVMP::1904            * MAPPING ROUTINE FOR DVS00
-
REL,%4DP43::1904            * POWER FAIL DRIVER
-
```

```
*                       USER PROGRAMS
-
MAP OFF,MODULES
-
REL,%CMM4::1904             * RTE-IV UTILITY PROGRAM
-
REL,%BMPG::1904             * FMGR MODIFIED FOR RTE-IV
-
REL,%EDITR::1904            * RTE TEXT EDITOR
-
REL,%4AUTR::1904            * POWER FAIL PROGRAM
-
REL,%4WHZT::1904            * RTE-IV WHZAT
-
REL,%4LDR::1904             * RTE-IV LOADER
-
*                      LIBRARIES
-
REL,%4SYLB::1904            * RTE-IV SYSTEM LIBRARY
-
REL,%BMLIB::1904            * RTE FILE MANAGEMENT LIBRARY
-
REL,%CLIB::1904             * RTE COMPILER LIBRARY
-
REL,%FF4.N::1904            * FORTRAN FORMATTER
-
REL,%RLIB1::1904            * RELOCATING LIBRARY PART 1
-
REL,%RLIB2::1904            * RELOCATING LIBRARY PART 2
-
DISPLAY UNDEFS
NO UNDEFS
-
/E
NO UNDEFS

PARAMETERS
-
D.RTR,1,1
-
EDITR,3,50
-
CMM4,1,90
-
WHZAT,3,41
-
AUTOR,4,10
-
PRMPT,1,10
-
R$PN$,1,10
-
/E
```

-GENERATION EXAMPLE-

```
CHANGE ENTS?
-
.MVW,RP,105777
-
/E


TABLE AREA I


EQUIPMENT TABLE ENTRY

EQT 01?
21,DVR31,D                      * EQT 1  - 7900 DISC

EQT 02?
15,DVR05,B,X=13                 * EQT 2  - 2645 SYSTEM CONSOLE

EQT 03?
4,DVP43,M                       * EQT 3  - POWER FAIL

EQT 04?
17,DVR02,B,T=50                 * EQT 4  - PUNCH

EQT 05?
16,DVR01,T=100                  * EQT 5  - PHOTOREADER

EQT 06?
20,DVR12,B,T=500                * EQT 6  - 2767 LINE PRINTER

EQT 07?
23,DVR23,D,B,T=9999             * EQT 7  - 7970 MAG TAPE

EQT 08?
25,DVR00,B                      * EQT 8  - 2640 AUX CONSOLE

EQT 09?
10,DVS00,B,M,T=1200,X=11        * EQT 9  - MUX PORT 0
```

SC is actual SC of lower MUX data card

Driver will change this to 40 on first call

```
EQT 10?
41,DVS00,B,M,T=1200,X=11        * EQT 10 - PORT 1

EQT 11?
42,DVS00,B,M,T=1200,X=11        * EQT 11 - PORT 2

EQT 12?
43,DVS00,B,M,T=1200,X=11        * EQT 12 - PORT 3

EQT 13?
44,DVS00,B,M,T=1200,X=11        * EQT 13 - PORT 4

EQT 14?
45,DVS00,B,M,T=1200,X=11        * EQT 14 - PORT 5

EQT 15?
46,DVS00,B,M,T=1200,X=11        * EQT 15 - PORT 6

EQT 16?
47,DVS00,B,M,T=1200,X=11        * EQT 16 - PORT 7

EQT 17?
50,DVS00,B,M,T=1200,X=11        * EQT 17 - PORT 8

EQT 18?
51,DVS00,B,M,T=1200,X=11        * EQT 18 - PORT 9

EQT 19?
52,DVS00,B,M,T=1200,X=11        * EQT 19 - PORT 10

EQT 20?
53,DVS00,B,M,T=1200,X=11        * EQT 20 - PORT 11

EQT 21?
54,DVS00,B,M,T=1200,X=11        * EQT 21 - PORT 12

EQT 22?
55,DVS00,B,M,T=1200,X=11        * EQT 22 - PORT 13

EQT 23?
56,DVS00,B,M,T=1200,X=11        * EQT 23 - PORT 14

EQT 24?
57,DVS00,B,M,T=1200,X=11        * EQT 24 - PORT 15

EQT 25?
/E
```

EQT's 10 through 24 use dummy select codes 41-57; No other cards may use these select codes

```
DEVICE REFERENCE TABLE

 1 = EQT #?
2                                * LU 1   - 2645 CONSOLE

 2 = EQT #?
1,1                              * LU 2   - 7900 DISC, UPPER

 3 = EQT #?
0                                * LU 3   - NO AUX DISK

 4 = EQT #?
2,1                              * LU 4   - CONSOLE LEFT CTU

 5 = EQT #?
2,2                              * LU 5   - CONSOLE RIGHT CTU

 6 = EQT #?
6                                * LU 6   - 2767 LINE PRINTER

 7 = EQT #?
3                                * LU 7   - POWER FAIL

 8 = EQT #?
7                                * LU 8   - MAG TAPE

 9 = EQT #?
8,1                              * LU 9   - 2640 CONSOLE

10 = EQT #?
4,6                              * LU 10  - TAPE PUNCH

11 = EQT #?
1,0                              * LU 11  - PERIPHERAL 7900

12 = EQT #?
9                                * LU 12  - MUX PORT 0

13 = EQT #?
10                               * LU 13  - MUX PORT 1

14 = EQT #?
11                               * LU 14  - PORT 2

15 = EQT #?
12                               * LU 15  - PORT 3

16 = EQT #?
13                               * LU 16  - PORT 4
```

```
17 = EQT #?
14                          * LU 17  - PORT 5

18 = EQT #?
15                          * LU 18  - PORT 6

19 = EQT #?
16                          * LU 19  - PORT 7

20 = EQT #?
17                          * LU 20  - PORT 8

21 = EQT #?
18                          * LU 21  - PORT 9

22 = EQT #?
19                          * LU 22  - PORT 10

23 = EQT #?
20                          * LU 23  - PORT 11

24 = EQT #?
21                          * LU 24  - PORT 12

25 = EQT #?
22                          * LU 25  - PORT 13

26 = EQT #?
23                          * LU 26  - PORT 14

27 = EQT #?
24                          * LU 27  - PORT 15

28 = EQT #?
9,1                         * LU 28  - PORT 0 LEFT CTU

29 = EQT #?
9,2                         * LU 29  - PORT 0 RIGHT CTU

30 = EQT #?
9,4                         * LU 30  - PORT 0 AUX PRINTER

31 = EQT #?
10,1                        * LU 31  - PORT 1 LEFT CTU

32 = EQT #?
10,2                        * LU 32  - PORT 1 RIGHT CTU

33 = EQT #?
10,4                        * LU 33  - PORT 1 AUX PRINTER
```

First two MUX ports are 2645 terminals with CTU's & printers

```
34 = EQT #?
5,4                          * LU 34  - PHOTO READER

35 = EQT #?
/E


INTERRUPT TABLE

-
4,ENT,$POWR                                          -
-                                                     |  Interrupt
10,ENT,P00D1                 * MUX DATA                \ entries for
-                                                      / actual select
12,ENT,P00C1                 * MUX CONTROL             |  codes of MUX
-                                                     _|  cards
15,EQT,2                     * SYSTEM CONSOLE (2645)
-
16,EQT,5                     * PHOTO READER
-
17,EQT,4                     * PUNCH
-
20,EQT,6                     * LINE PRINTER
-
21,EQT,1                     * 7900 DISK
-
22,EQT,1                     *  DISK
-
23,EQT,8                     * 7970 MAG TAPE
-
24,EQT,8                     *  MT
-
25,PRG,PRMPT                 * AUX CONSOLE (2640)
-
```

```
40,PRG,PRMPT                    * MUX PORT 0
-
41,PRG,PRMPT                    * PORT 1
-
42,PRG,PRMPT                    * PORT 2
-
43,PRG,PRMPT                    * PORT 3
-
44,PRG,PRMPT                    * PORT 4
-
45,PRG,PRMPT                    * PORT 5
-
46,PRG,PRMPT                    * PORT 6
-
47,PRG,PRMPT                    * PORT 7
-
50,PRG,PRMPT                    * PORT 8
-
51,PRG,PRMPT                    * PORT 9
-
52,PRG,PRMPT                    * PORT 10
-
53,PRG,PRMPT                    * PORT 11
-
54,PRG,PRMPT                    * PORT 12
-
55,PRG,PRMPT                    * PORT 13
-
56,PRG,PRMPT                    * PORT 14
-
57,EQT,24                       * PORT 15
-
/E
```

Dummy entries for each MUX port

Port 15 is for 2631 Printer

```
   TABLE AREA I MODULES

   $$TB1(0099)03501 03623  92067-16014 REV.1805 780223
      *$ERAB  03506
      *$PVCN  03510
      *EXEC   03503
      *$LIBR  03512
      *$LIBX  03517
      *$PVST  03511
      *$UPIO  03524
      *$CIC   03526
      *$XCIC  03531
      *$YCIC  03533
      *$UIN   03535
      *$UCON  03542
      *$XEQ   03554
      *$XDMP  03556
      *$IDLE  03563
      *$SCD3  03572
      *$IDNO  03576
      *$MEU   03607
      *$LIST  03566
      *$MESS  03602
      *$WORK  03610
      *$$OP   03611
      *$ULLU  03612
      *$CGRN  03616
      *$MTM   03622
      *$OPSY  03623
   BP LINKAGE 01643

   DRIVR PART 00002
    CHANGE DRIVR PART?
   2                    * CHANGE DP SIZE


   DP  01:

   DVR31(0099)06000 07177  29013-60001 REV.1710 770216
      *I.31   06645
      *C.31   06214
   BP LINKAGE 01635

   DVR00(0099)07226 10332  29029-60001 REV 1740 770808
      *I.00   07226
      *C.00   07610
      *I.01   07226
      *C.01   07610
      *I.02   07226
      *C.02   07610
   BP LINKAGE 01633
```

```
DVR12(0099)10354 11112   29028-60002  780103  REV 1805
   *I.12   10354
   *C.12   10701
BP LINKAGE 01633

DVR23(0099)11113 11756      92202-16001  REV. A
   *I.23   11113
   *C.23   11730
BP LINKAGE 01633


SUBSYSTEM GLOBAL AREA

LDVR5     )12073 15361   91731-16003  REV.1901


RT COMMON  00000
 CHANGE RT COMMON ?
200                  * RT COMMON CHANGE
RT COM ADD     15424


BG COMMON  00036
 CHANGE BG COMMON ?
0                    * BG COMMON CHANGE
BG COM ADD     15734
BG COMMON  00036


SYSTEM DRIVER AREA

DVS00(0099)16000 21623    91731-16001  REV.1901
  PVMP4    21715 22017  92067-16001 REV.1805 771219

DVP43(0099)22031 22665  92067-16004 REV.1805 771219


TABLE AREA II
   .
   .
   .
(Remainder of listing omitted)
```

READER COMMENT SHEET

HP 91731A ASYNCHRONOUS MULTIPLEXER SUBSYSTEM
Configuration Guide

91731-90003 **DEC 1978**

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Is this manual complete?

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Other comments?

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